

Discussion

Reply to comment on: “A densely feathered ornithomimid (Dinosauria: Theropoda) from the Upper Cretaceous Dinosaur Park Formation, Alberta, Canada”



Aaron J. van der Reest^{*}, Alexander P. Wolfe, Philip J. Currie

Department of Biological Sciences, University of Alberta, Edmonton, AB T6G 2E9, Canada

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ABSTRACT

We confirm the presence of pigmented keratinized integumentary structures attributable to feathers in the Late Cretaceous *Ornithomimus* specimen UALVP 52531. We falsify the hypothesis that these features represent collagen fibers and address additional criticisms of our paper made by Lingham-Soliar (2016).

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1. On measurement and scale

We welcome the opportunity to address comments made by Lingham-Soliar (2016) on the integumentary structures associated with UALVP 52531, a recently described *Ornithomimus* from the Late Cretaceous of Alberta, Canada (van der Reest et al., 2016). We first address the issues of measurement and scale, stated bluntly by Lingham-Soliar (2016) as “a vague reference to the ‘feather’ width range of between 0.2–0.5 mm and to a solitary example on the body of UALVP 52531 that is 0.4 mm” followed shortly thereafter by “This leaves no option but to trust the scale bar on their Fig. 4 and try to establish what they mean by feathers in the context of width and structure.” In no manner are our measurements or illustrated scale bars lacking in accuracy or precision. To make this point clear, in Fig. 1 of this rebuttal Figs. 1A–C are reproduced from the original alongside the unedited photograph of the specimen in question with ruler in place (Fig. 1D). Simply stated, there is nothing remotely disingenuous or deceptive about this scale bar, or any of the others presented by van der Reest et al. (2016). Indeed, these illustrations were deemed satisfactory, as initially submitted, to

both anonymous reviewers and the editorial office of *Cretaceous Research*. Moreover, this scale bar is consistent with, and enables confirmation of, the filament dimensions reported in the text of van der Reest et al. (2016). As can be seen in Figs. 1B and C, there are many more than a “solitary example” of the two filament populations observed. There are numerous fine elements branching from more robust structures that are interpreted as feather rami and rachises, respectively. There is no evidence of feather barbule preservation in UALVP 52531. As stated, the detailed analyses of the microstructure and chemistry of preserved integumentary features are forthcoming, but we can specify that these two filament populations have dimensions of $49 \pm 9 \mu\text{m}$ (range: 30–60 μm , $n = 79$) and $253 \pm 66 \mu\text{m}$ (range: 110–450 μm , $n = 81$). We thank Lingham-Soliar (2016) for requesting this information and acknowledge our omission, but we emphasize that the data and illustrations presented by van der Reest et al. (2016) are correct, and that our interpretation of UALVP 52531 remains unchanged.

2. Feathers adorning UALV 52531

On page 109 of van der Reest et al. (2016) we wrote: “The most common integumentary structures are unambiguous feathers comprising filaments that range from 25–87 mm in length and 0.2–0.5 mm in width, preserved as dark carbonaceous imprints

^{*} Corresponding author.

E-mail address: avanderr@ualberta.ca (A.J. van der Reest).

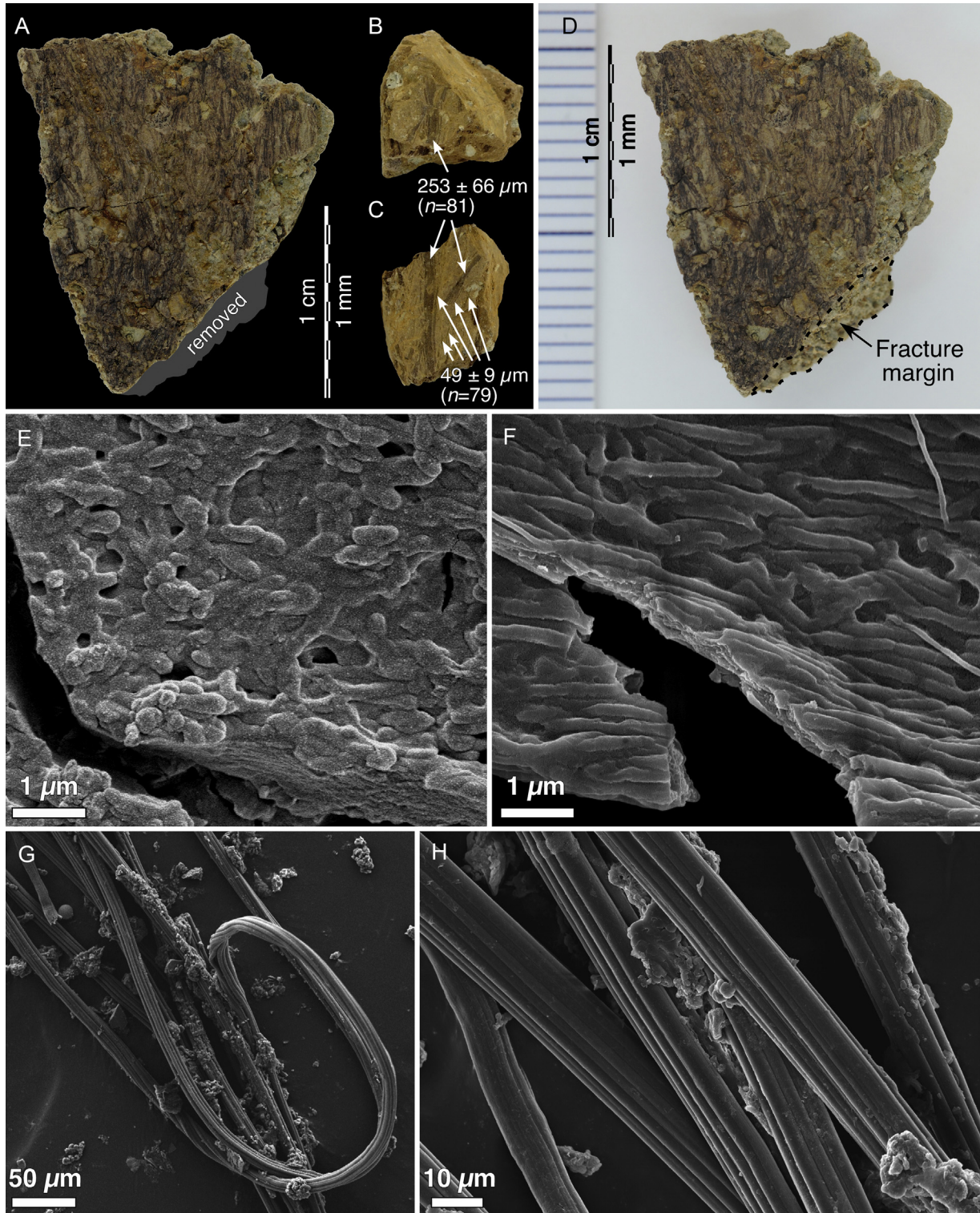


Fig. 1. Keratinous integument and collagen fibers. (A–C) Direct reproduction of Fig. 4 from van der Reest et al. (2016), with the following additions: measurements of coarse (rachises) and fine (rami) feather elements in (B) and (C), and shading of the fractured vertical margin of the specimen that was edited from the original (D) in order to restrict (A) to surfaces in focus. (D) The original unedited photograph that became Fig. 4A, where the ruler on left is the basis for the digital scale, identical as that in (A). The digital scale is slightly longer than the photographed ruler in order to compensate for specimen height. (E) Surface and fracture margin of one of the “dark carbonaceous imprints” from the ilium of UALVP 52531 observed with field-emission scanning electron microscopy (FE-SEM). The μm -scale bacilloid shapes are melanosomes. (F) Comparable features, at the same scale as (E), from a rufous tail feather of *Buteo jamaicensis* (red-tailed hawk) digested briefly in 1 M Na_2S . In (G) and (H) are FE-SEM images of collagen fibers extracted from a Middle Pleistocene *Mammuthus primigenius* pelvis, ~600 ka in age, from the Yukon Territory and buried in frozen ground (Dominion Creek locality, Klondike gold fields, $63^\circ 46' \text{N}$, $138^\circ 32' \text{W}$). Each fiber has a diameter $\leq 15 \mu\text{m}$, and is comprised of much finer ($< 1 \mu\text{m}$) fibrils. The finest carbonaceous elements in UALVP 52531 measure $30 \mu\text{m}$ in diameter, but average $49 \pm 9 \mu\text{m}$, much wider than the coarsest collagen fibers, as shown by comparison of (B) and (C) to (G) and (H). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

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